

Educational Resources from *Phenomenon Science Education*
Student Proficiency Goals for Performance Expectation **4-PS3-3**



Information about Performance Expectation 4-PS3-3

Performance Expectation 4-PS3-3.

Ask questions and predict outcomes about the changes in energy that occur when objects collide.

Clarification Statement.

Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.

Assessment Limits.

Assessment does not include quantitative measurements of energy.

Science and Engineering Practice (Asking Questions and Defining Problems)

- Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.

Disciplinary Core Idea (PS3.A: Definitions of Energy)

- Energy can be moved from place to place by moving objects or through sound, light, or electric currents.

Disciplinary Core Idea (PS3.B: Conservation of Energy and Energy Transfer)

- Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced.

Disciplinary Core Idea (PS3.C: Relationship Between Energy and Forces)

- When objects collide, the contact forces transfer energy so as to change the objects' motions.

Crosscutting Concept (Energy and Matter)

- Energy can be transferred in various ways and between objects.

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SEP (Asking Questions and Defining Problems):

- Students observe phenomena related to collisions and identify changes in energy associated with those collisions.
- Students ask questions, which can be investigated using classroom-available resources, about energy transfers in collisions.
- Students examine collected or provided data that show transfers of energy in a collision.
- Students examine collected or provided data to determine patterns of energy transfer in collisions.
- Students examine collected or provided data to identify cause and effect pairs that represent energy transfer in a collision. For example: A moving ball collided with a ball that was at rest and then the ball at rest started moving. The moving ball caused energy to be transferred to the ball that was at rest, resulting in the ball at rest moving and the moving ball moving more slowly.
- Students ask questions about the data to predict changes in energy that are likely to occur during a collision.
- Students ask questions about the data to make predictions about the likely outcomes of collisions.

DCI (PS3.A Definitions of Energy):

- Students know that energy can take the form of sound, heat, or motion.
- Students know that energy can be moved from one place to another through sound, heat, or motion.

CCC (Energy and Matter):

- Students think about the ways that energy can be transferred in a collision.
- Students consider that sound, heat, and motion are all forms of energy that can be transferred in a collision.

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DCI (PS3.B Conservation of Energy and Energy Transfer):

- Students know that energy is present when moving objects, sound, light, or heat are present.
- Students know that when objects collide, energy can be transferred from one object to other objects, changing the motion, speed and/or direction of those objects.
- Students know that when objects collide, energy can be transferred to the surrounding air.
- Students know that when a collision occurs and energy is transferred to the surrounding air, it can take the form of heated air particles and/or sound.

DCI (PS3.C Relationship Between Energy and Forces):

- Students know that collisions transfer energy.
- Students know that in collisions, energy is transferred through contact forces.
- Students know that contact forces can change the motion, speed and/or direction of all objects involved in a collision.